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THOMAS SÖDERQVIST

Medical Museion, University of Copenhagen,
Denmark

Who's afraid of the recent biomedical heritage?

Medicine is one of the oldest and most venerated ingredients of the world's cultural and scientific heritage. Consequently medical artefacts feature prominently in many university museum collections[1]. With respect to the historical time range covered, however, almost all museums deal with what might be called 'modern medicine', that is, they mainly contain artefacts and ideas that represent the medical practices of the modern era, from seventeenth century anatomical specimens to late-twentieth century mechanical medical instruments. With few exceptions, museums have not yet taken the rapidly growing biomedical culture of our present age into account, and so far no museum has made systematic efforts to document the recent biomedical heritage[2].

I suggest it is time for university museums to take biomedicine – that is, the fusion of cell biology, molecular biology and information technology with clinical diagnostics and therapeutics – seriously[3]. The reason is, of course, that biomedicine is emerging as a significant formative part of contemporary society and culture. The discovery of the structure of DNA in 1953 and the subsequent rise of molecular biology have radically changed the research agendas, strategic decisions, and curricula of medical faculties over the last decades. A rapidly growing number of new molecular technologies have changed diagnostic and therapeutic methods beyond recognition; today's clinical biochemical laboratory is a highly sophisticated and robotized molecular diagnostic system and gene therapy is becoming clinical reality. Digitalization too has changed biomedical research and clinical practices drastically in the last decades. Medical research is highly dependent on computerized methods. Clinical departments like neonatal

[1] K. Arnold, *Time heals: making history in medical museums* [in:] G. Kavanagh (ed.), *Making Histories in Museums*, Leicester University Press, London 1996, p. 15–29.

[2] A notable exception is Science Museum, London, which has devoted the major part of a whole new extension, The Wellcome Wing, to exhibitions of recent biomedicine (see http://www.sciencemuseum.org.uk/wellcome-wing/splash_ie.html).

[3] 'Biomedicine' as defined here excludes nursing, social medicine, classical epidemiology, social psychiatry, etc. 'Recent' is defined as the period covering the professional life of historical biomedical actors that are presently living, i.e., approx. the last 50 years.

wards or intensive care units are as digitalized as the cockpit in a modern aircraft. Diagnostic imaging tools like CT-, MR- and PET-scanning would be impossible without advanced digital technology.

This combined process of molecularization and digitalization of the laboratory and the clinic (in other words, biomedicalization)[4] is embedded in a broader social and cultural context. The many (and often politically mediated) interactions between the transnational 'biomedical-industrial complex' and the steadily growing popular demand for better health care are turning biomedicine into a significant player on the global economic arena[5]. Biomedicine has also entered the political scene. While some view its recent developments as a threat to basic human values, others see it as a key to the future of humankind. New technologies such as stem cell manipulation, cloning, and tissue engineering have raised both professional and popular expectations of the powers of biomedicine to combat, for example, cancer and degenerative diseases.

How can university museums accommodate to these material and discursive changes in the medical landscape? What consequences will the recent revolution in biomedical research and clinical development have for medical history collections and exhibitions? In the Medical Museion at the University of Copenhagen we are presently trying to resolve these and similar questions[6]. In this paper I will discuss one of the museological problems raised, viz., how to handle the abstract and non-tangible character of many recent biomedical objects.

The Medical Museion is the continuation of the Medical History Museum in Copenhagen, founded by a private initiative in 1906. The rapidly expanding collections were taken over by the university in 1918, and thirty years later they were moved to their present location in the former Royal Academy of Surgeons and adjacent buildings. Today the University of Copenhagen owns one of the largest and most diversified medical history university collections in the world, including thousands of obstetric, radiological, ophthamological, dental, and surgical instruments, several complete apothecaries and old pharmaceutical laboratories, an interesting assortment of microscopes, and a world-famous osteopathological collection from medieval leprosaria. Altogether the collections comprise approx. 60.000 registration units (a registration unit may contain many separate physical items so the number of individual objects probably exceeds a hundred thousand); in addition there are close to 100.000 iconographical items, a library of 30.000 volumes, and approx. 4000 archival units, including hospital patient records from the late eighteenth century and onwards. Only a small proportion of this material is displayed in the public exhibitions; most is kept in storage or in special 'study collections' for specialists.

Like most other medical university museums, the collecting and exhibition activities of the Medical History Museum were focused on 'modern medicine', especially on instruments that documented the triumph of the modern medical profession in the late

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[4] For an analysis of biomedicalization, see A.E. Clarke, J.K. Shim, L. Mamo, J.R. Fosket and J.R. Fishman, *Biomedicalization: technoscientific transformations of health, illness, and U.S. biomedicine*, „American Sociological Review", 2003, vol. 68, p. 161–194.

[5] Cf. the notion of 'biomedical complex' [in:] J.-P. Gaudillière, *Inventer la biomedicine: la france, l'amérique et la production des savoirs du vivant (1945–1965)*, La Découverte, Paris, 2002.

[6] Th. Söderqvist, *Medicinsk Museion*, „Novo Nordisk Fondens Årsskrift", 2004–2005, p. 28–33; Th. Söderqvist, *Kan den moderne biomedicin udstilles på museum?*, „Bibliotek for Læger", 2005, vol. 197, p. 171–189.

nineteenth and first half of the twentieth century. But in recent years the museum has changed its orientation. The incentive for this move was the fact that the museum had stagnated since the 1970s; there were no research activities of any significance, the collections were run by amateur curators, and the exhibitions had not been revised for decades. A devastating report by The Danish State Board of Museums in 2000 raised negative headlines ('Chaos in the museum') in the Danish medical weekly[7], and induced the Faculty of Health Sciences to take its responsibility as owner. A year earlier, the chair in history of medicine had been filled to boost medical history research; in the following years three new museum positions were announced. Basic funding was increased as well, and in 2003 the faculty gave its unanimous support to a five-year plan for re-conceptualizing the former Medical-History Museum as a Medical Museion.

The Medical Museion concept is two-pronged. The basic idea is that research, teaching, collection activities and public outreach (including exhibitions) are closely integrated activities that mutually support each other. The classical notion of 'museion' has been chosen to symbolize the bridging of the gap between a traditional academic medical history research and teaching culture focusing on the production of texts (articles, books), and a traditional curatorial culture dealing with the acquisition, preservation and exhibition of material objects and images. In daily practice, this bridging means that both research and museum staff attend the weekly seminar dealing with all aspects of the institution, from registration systems and conservation methods to the history and philosophy of biology and the interaction between biomedicine and art; guest speakers include medical researchers, historians, ethnologists, museologists and artists. In other words, instead of making the traditional distinction between an academic university department and a museum, research, curating and acquisition are considered to be closely related forms of 'inquiry', and scholarly publishing, teaching and exhibitions are seen as closely related aspects of 'presentation'.

The other main idea behind the Medical Museion concept is to shift the focus to the understanding, documentation and presentation of recent biomedicine in its social and cultural context. From the point of view of our university identity this shift of focus is advantageous as a growing number of conferences, monographs and research articles on different aspects of biomedicalization have appeared in the last decade. In other words, we are joining a growing trend among historians of science, historians of medicine, and scholars of science studies to investigate the recent history of biomedicine.

From the point of view of our museum identity, however, the new focus on recent biomedicine does raise some problems. With the exception of the Science Museum in London, very few museum institutions have taken the recent biomedical revolution seriously, and even fewer have begun to systematically acquire biomedical artefacts. Most medical history exhibitions still present medicine as it were in the period from the late eighteenth to the mid-twentieth centuries, that is, before molecular biology and information technologies began to change its face.

However, if (or rather when) museums begin to pay attention to recent biomedicine, they will be running into a major museological problem. This problem has to do with the object character of biomedical artefacts. Traditionally, museums are institutions that deal with material objects and material culture. The key-word here is tangibility –

[7] J. Haller, *Kaos på museet: vi kan skabe et unikt museum*, „Ugeskrift for Læger", 2001, vol. 163, p. 2158–2161.

and medical museums are no exceptions, filled as they are with surgical instruments, microscopes, contraceptive devices, iron lungs, hospital beds, anatomical specimens, and so forth. Medical museum curators usually do not consider it a problem to define what an 'object' is, or what constitutes a 'good' museum object. Good objects are concrete, sensual and spectacular, like foot-driven dentist's drills, siamese twins in jars, amputation saws, and trepanation instruments in handy travel sets. These and similar objects are considered 'good' objects because they are made of easily recognizable materials and resemble familiar tools; they are immediately understandable and also appeal to our fear of pain and death; they trigger the visitor's attention, elicit memories, evoke emotions, and make us pause in front of the objects with a sense of curiosity and wonder. The lithoclast – an instrument invented in the early nineteenth century to crush bladder stones through the urethra (thus lowering the risk and pain of classical stone cutting) – is an archetypically 'good' medical history exhibition object. Young male visitors to the Medical Museion regularly turn pale when they realize how the instrument was used – before anaesthesia.

The emergence of recent biomedicine, however, challenges this classical notion of material objects as familiar, tangible, and sensuous. Today's biomedical objects are neither familiar, nor tangible; neither sensuous, nor emotionally evocative. To illustrate the challenges of recent biomedicine to university museums, I will shortly discuss three cases: DNA microarray analysis, PET scanning, and molecular therapy.

Microarray analysis is one of the most sophisticated methods in post-genomic medicine. Based on the fact that the degree of hybridization between single-stranded oligonucleotide molecules is a measure of their similarity, it uses arrays of hundreds of thousands of specific oligonucleotide sequences as probes to map an unknown RNA/DNA-sample; this makes it possible to gauge the gene expression level of the entire genome (that is, which genes are 'on' and which are 'off') in one single run. The analytical power of the method has ushered a rapid growth of expectations in the biomedical research community and the pharmaceutical industry to use it as a major diagnostic and therapeutic tool, for example for individualized drug treatment: 'The explosion in interest in DNA microarrays has almost been like a gold rush', proclaims a textbook in the field[8].

The most widely used and best known microarray platform, the Affymetrix GeneChip®, was invented in the late 1980s and came into industrial production a few years later[9]. By combining information technology and molecular biology the GeneChip embodies the very essence of biomedicine. It illustrates the restructuring of health-care in the advanced post-industrial societies towards increased individualisation of diagnostics and treatment. Also, by drawing on globally produced and globally available sequence data bases it epitomizes another salient aspect of the biomedical revolution, viz., its integration in the process of globalization. Furthermore, as one of the few biomedical technologies that has made it to the front-page of Financial Times, the GeneChip is an example of how cutting-edge university research often has given rise to successful private enterprises (the 'Silicon Valley effect') over the last decades. Finally it reminds us of Peter Sloterdijk's point that biotechnology, for better or for

[8] S. Knudsen, *Guide to Analysis of DNA Microarray Data*, Wiley, 2nd ed., New York, 2004, p. 2.

[9] For Affymetrix' own historiography, see http://www.affymetrix.com/support/technical/other/pioneer_brochure.pdf

worse, can make the old vision of eugenics come true[10]. The Affymetrix GeneChip thus provides an ample focusing point for historians of recent biomedicine and biotechnology.

For museums curators, however, the GeneChip poses a problem. What is immediately available for display is just the handy 1 x 2 inch plastic casing where the hybridization reaction takes place. The ½ x ½ inch 'chip' inside, with some half million oligonucleotide molecular-sized probes attached to it, is not immediately visible, or intelligible. The result of the test is only visible indirectly; the genome data are produced by reading the hybridization pattern on the chip with a laser scanner (which looks like an advanced coffee machine) and the result is interpreted by a computer program. It is hardly necessary to say that the GeneChip technology, which is now revolutionizing medical diagnostics, makes poor museum objects because all the components of the platform are abstract, intangible and hardly evoke any memories or strong emotional reactions.

The PET (positron emission tomography) scanner, too, illustrates the problem of displaying new biomedical artefacts in a museum exhibition. The instrument is built to produce images representing the inner metabolism of the body; information that is indeed useful for diagnostic purposes. The patient is injected with glucose molecules marked with a short-lived isotope that emits positrons that can be measured by a detector. The ensuing data are then interpreted by a computer program to represent slices (tomography) of the spatial distribution of glucose metabolism in the body on a screen. For example, the screen image of metabolism in the brain of patients with Alzheimer's disease is significantly different from that in 'normal' patient brains.

The PET scanner is an impressive piece of combined digital and molecular technology which has already had great impact on medical diagnostics. An update of earlier imaging technologies, like X-ray, as it were – and as such it is a 'must' in any museum that wishes to document and exhibit significant features of recent university medicine. But whereas X-ray technology is relatively easily understood in terms of 'modern medicine' and does not create any problems for medical museum curators, the PET scanner poses at least two museological problems.

One problem is that the PET scanner defies traditional museological display strategies. The directly visible and tangible 'objects' – the enclosing cabinet and the bed which the patient is placed on during the scanning procedure – are not at all important for the functionality of the scanner. The working material parts are either invisible and non-tangible (the isotope molecules) or non-intelligible (the detector and the computer hardware) and in addition do not make much sense without the resulting screen image. The 'image' in turn is indeed visible as long as the machine runs, but it is not tangible; it is the ephemeral result of the handling of signal data by the 'text' (that is, the computer programme code). The other problem (and this is why I have placed the words 'object', 'image' and 'text' between inverted commas) is that the PET scanner blurs the traditional categories of 'object', 'image' and 'text'. How shall this artefact be classified? Does it belong among the physical museum objects? Or is it better placed (as an image) in the iconographical collection? Or even (as program code) in the archive?

My last example of how recent biomedicine is a challenge to university museums is the advent of molecular therapy. Traditionally, pharmacology is based on trial-and-

[10] P. Sloterdijk, *Regeln fur den Menschenpark*, SuhrkampVerlag, Frankfurt am Main, 1999.

-error experience. The administered drug may not even be chemically characterized (as in folk herbal medicine) and physicians usually have no knowledge of the biochemical mechanism behind the effect; it just happens to work. Now, however, the biochemical mechanism that mediates between the active substance and the physiological response is being elucidated in a growing number of cases. A good example of molecular therapy is AstraZeneca's Losec®, the world's best-selling drug against ulcer and heartburn in the 1990s. Earlier, ulcer patients were often treated with surgery; today they are given antibiotics against the Heliobacter infection and Losec to lower stomach acidity (often in the form of combination therapy).

The active substance in Losec is a synthetic molecule, omeprazol, that specifically blocks the proton pump and hence acid production in the stomach. In other words, the omeprazol molecules work as a kind of specific biochemical microsurgery. It is thus a smart medical technology (and a major source of income for AstraZeneca) – but it is hardly a best-seller for medical museums. True, the Losec pill is tangible, but it looks very much like all other pills. The trillions of 'molecular knives' (omeprazol molecules) are intangible and invisible. The ion channels in the gastric lining are tangible on the microscopic level, but not visible to the naked eye. Furthermore, the most interesting 'object' is neither the pill nor the molecule, but the international network of scientists, medical doctors, advertising firms, and financial analysts who made a business success out of the omeprazol molecule. One could, of course, put the pill on a piece of black cloth under a spotlight and play a recorded deep voice telling the visitor that it gave AstraZeneca a 8 billion dollar revenue in the year 2000 only. But such stories are probably better told in books and magazines than in exhibitions. Likewise, the molecular and biological mechanisms of omeprazol may be better told in book pages and computer screens than in museums.

Microarray systems, PET scanners, and molecular therapies exemplify the problems involved in collecting and exhibiting recent biomedicine. Consequently I believe that medical museums today are caught in a paradox. On the one hand, biomedical research and technology fills more and more of our lives. On the other hand, the whole idea of what constitutes a medical museum collection and what is displayable in a medical museum exhibition is open to question, because medical diagnostics and treatment has become less visible and less sensuous. The biomedical ideas and artefacts of the last decades are very different from those presently gathered and displayed in museums. They are smaller (often microscopic), more abstract and mediated, less tangible (if not altogether intangible), and generally much less emotionally evocative than traditional 'modern medical' objects. And sometimes they are not even material artefacts in the classical sense, but 'boundary artefacts'[11], that is simultaneously 'material objects', 'texts' and 'images', depending on the context of interpretation.

There may come a point when it becomes impossible to display such objects in a museum exhibition in any meaningful way. After all, who would come to the local university museum on a Sunday afternoon to read computer manuals, look at anonymous instrument plastic cabinets discretely labelled Perkin-Elmer or Hewlett-Packard, or watch video screens that represent repetitive patterns of DNA hybridization reac-

[11] The notion of 'boundary artefact' is adopted from S.L. Star and J.R. Griesemer, *Institutional ecology, 'translations' and boundary objects: Amateurs and professionals in Berkeley's Museum of Vertebrate Zoology, 1907–1939*, „Social Studies of Science", 1989, vol. 19, p. 387–420.

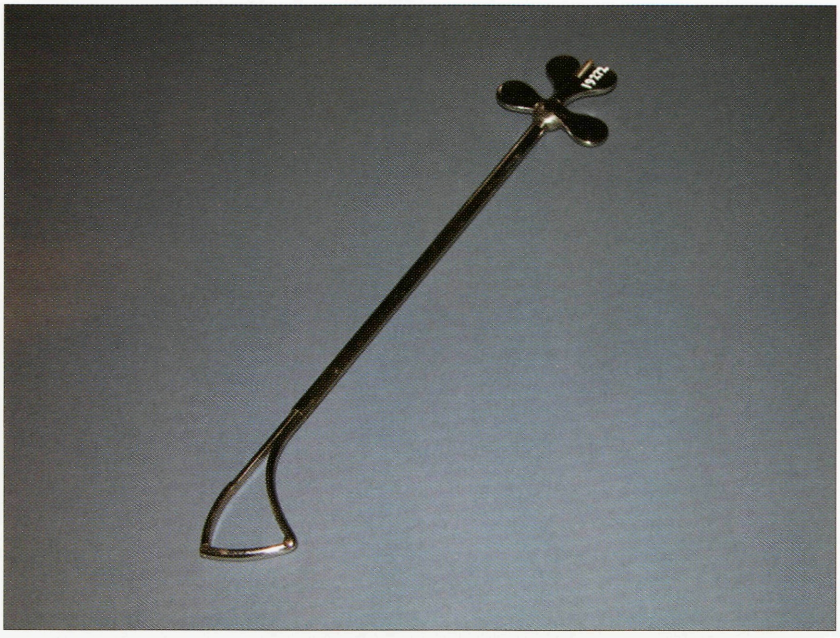
tions? Will not those who are curious about the emergence of recent biomedicine and its impact on the world rather download the molecular images on their own computer or read about the global biomedical economy on a webpage or in a book or a magazine article instead? It makes sense to visit the local university museum to see lithoclasts, amputation saws, and siamese twins in jars. But why at all visit a museum if one wants to watch displays which elicudate the basic textbook principles of a PET scanner, a gene microarray or a 'molecular knife'?

I believe this is a genuine museological problem and one that all museums with medical collections and exhibitions will have to solve in the near future – unless they want to restrict their activities to the safe realm of 'modern medicine'. I am not pretending that the Medical Museion in Copenhagen has a solution in sight or even a smart way of circumventing it. But we are presently working on explicating and conceptualizing the problem, and with some help from our colleagues in the university museum world we will hopefully together be able to find solutions in the future.

STRESZCZENIE

Kto się obawia najnowszego dziedzictwa biomedycznego?

Ponieważ biomedycyna – fuzja biologii komórkowej, biologii molekularnej oraz informatyki z diagnostyką i terapeutyką kliniczną – staje się znaczącą częścią współczesnego społeczeństwa i kultury, czas, by muzea uniwersyteckie poważnie zaczęły traktować tę dyscyplinę nauki. Muzeum Medyczne przy Uniwersytecie w Kopenhadze stara się obecnie rozwiązać problemy muzealne związane z przedstawieniem najnowszych artefaktów biomedycznych. Tradycyjnie muzea zajmują się wymiernymi obiektami materialnymi: dobre artefakty muzeum medycznego są konkretne, spektakularne i działające na zmysły, a także łatwo zrozumiałe; przywołują wspomnienia i wywołują emocje. Jednakże pojawienie się biomedycyny zmienia klasyczne pojęcie eksponatów muzealnych jako przede wszystkim wymiernych i pojmowanych zmysłami. Dzisiejsze obiekty biomedyczne są abstrakcyjne, niematerialne i trudne do zrozumienia; przywołują one niewiele wspomnień i nie wywołują żadnych emocji. Wyzwania stawiane przez biomedycynę muzeom uniwersyteckim przedstawiono w odniesieniu do trzech przykładów: analizy układu DNA, obrazowania pozytronowego PET oraz terapii molekularnej. Niniejsza praca stawia wniosek, iż obecnie muzea medyczne są ofiarą paradoksu. Z jednej strony badania biomedyczne i technologia coraz bardziej wypełniają nasze życie, od opieki nad noworodkami do oddziałów intensywnej opieki dla osób nieuleczalnie chorych. Z drugiej strony, zaczyna być problematyczne ukazanie tego, co jest ideą muzeum historii medycyny, z przedstawieniem jego kolekcji w sposób, który byłby zarazem ekspozycyjny, jak i łatwo zrozumiały dla publiczności.



Il. I. The lithoclast, designed by Ludvig Levin Jacobsen (1783–1843), is a typical tangible object which provokes the museum visitor's emotions. It was inserted through the urethra (without anaesthesia) to crush bladder stones (courtesy Medical Museion, University of Copenhagen)

Il. II. The GeneChip® is an icon of high tech biomedicine and an example of the intangible character of recent biomedical objects. This Human Genome U133A array from Affymetrix which can analyze the expression level of 14.500 well-characterized human gens in one single run hardly raises any emotions in visitors (courtesy Medical Museion, University of Copenhagen)